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Thermal Engineering

Russian Fissile Material Storage Facility Project-Heat Transfer Experiments at ESA-EPE

The Russian Fissile Material Storage Facility project assists the Defense Threat Reduction Agency (DTRA) by assuring safe, secure, and ecologically sound storage of fissile material derived from dismantled Russian nuclear weapons and by fulfilling bilateral US and Russian disarmament agreements. At the end of this project a state-of-the-art Russian facility will be ready to receive 50 metric tons of weapons-grade plutonium with the option to receive an additional 200 metric tons of weapons-grade uranium.

Figure 1: The nest tube with copper cooling tubes attached to the outer diameter.

The storage facility will be the largest and most modern facility of its kind anywhere in the world based on a very conservative design to resist external security threats and a full spectrum of natural and manmade hazards. The facility will meet strict accountability and verification requirements and will be placed under the IAEA safeguards program. As one of the most effective measures to deny access to a major fraction of the world's weapons-grade plutonium, this facility will make the world safer for us all. Los Alamos National Laboratory is playing a key role by providing the technical support to 1) optimize the storage of plutonium, 2) demonstrate adequate safety, and 3) verify over the lifetime of the facility the secure storage of fissile materials.

Design optimization is focused on maximizing the allowable plutonium storage without exceeding material thermal limits. This effort consists of a two-part complementary international program to evaluate the thermal environment within the storage facility and to establish plutonium loading limits based on physical data. ESA-EPE personnel have been tasked with aiding in the experimental side of the optimization process.

A series of full-scale thermal experiments will be conducted by ESA-EPE to validate the thermal models, measure heat transfer coefficients and emmissivity, and quantify the thermal margins in the design more precisely. For these tests, an actual nest tube that will be used to store plutonium or uranium at the Russian facility has been assembled in building 16 at TA-46. Figure 1 shows a photo of the nest tube in its present state. Copper tubing, as well as PVC supply and return manifolds, have been attached to the nest tube in preparation for a July testing date.

Although the test apparatus is prototypic, simplified boundary conditions will be used in these experiments in order to reduce the computation time of the numerical model. In order to maintain a constant temperature boundary condition on the exterior of the nest tube, chilled water will flow through copper tubes that have been strapped to the outer diameter. Eight canisters that have been instrumented with heaters will be placed inside of the nest tube to concomitantly provide an isoflux boundary condition and simulate the heat load generated by radioactive sources within the nest tube.

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Russian Fissile Material Storage Facility
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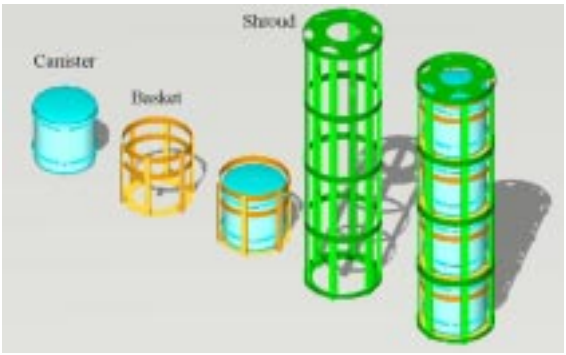

Figure 2: Placement of canisters in the shrouds.

Figure 2 shows a schematic of how the canisters are loaded into the nest tube. Each of the eight canisters is placed in a basket, and four basket-canister assemblies are placed in a shroud. The two shrouds are then lowered into the nest tube to form a vertical annulus with the isoflux boundary condition on the inner surface and the constant temperature boundary condition on the outer surface.

The fabrication of the test apparatus is complete and shakedown tests will commence the week of July 9. The testing phase is expected to last until October of this year. For more information contact Don Quintana with Thermal Engineering.

ESA-EPE Experimental Team:

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Dave Nelson

Stepping Back in Time

Dave in the high country between the Urique and Batopilas drainages (about 1 mile up from the bottom of the canyon).

Once a year, Dave Nelson sheds the constraints of the modern world; travels to Copper Canyon, Mexico; and disappears into another time on horseback. Dave says that these horse trips afford him the freedom and space to relax, regroup, and return to a simpler way of life, stepping back in time 100 years or so into a world where the primary modes of transportation are by foot or on horseback.

Dave's annual treks in Mexico began in the mid-1990s, when a group of his college friends decided to have a reunion. For their reunion site they chose the Rancho del Oso, a friend's ranch near Copper Canyon in the high country of southwestern Chihuahua. The Ranch offers horseback trips, lodging, jeep rides, and back-packing excursions into various parts of Copper Canyon.

The story goes that one night over a few too many margaritas, Doug, the ranch owner, asked the circle of friends if they would like to accompany him on a horse trip that he was leading the next morning. The friends, in a certain state of inebriation, enthusiastically agreed. The next morning amongst much grumbling and blurry-eyed discontent, the friends saddled up and headed out for a 4-day horse trip. That was Dave's first horse trip in the Urique branch of Copper Canyon, and he's been hooked ever since.

Although the area has canyons that are deeper than the Grand Canyon, it has a limited geologic history of only 20 to 40 million years (versus the billions of years of geologic history of the Grand Canyon). Copper Canyon itself is actually a complex system of mountains and canyons located in a remote section of Mexico's Sierra Madre mountains. The two main

canyons are the Urique (the deepest) and the Sinforosa. The whole area is made up of ash falls, mud flows, and explosive volcanic ash flows. The climate is dry, and water is scarce except at the bottom of the canyons. There are few trails and even fewer roads, and those that do exist were created out of necessity rather than recreation. The few roads and trails that do exist are usually not marked in any fashion. Towns are few and far between. Small ranches do exist throughout the canyon but are typically more than a 1/2-day's ride apart.

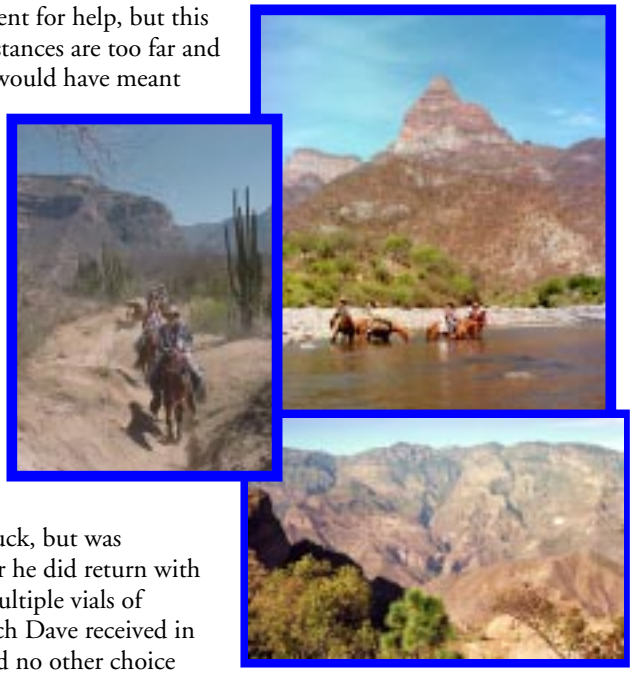
The people of the canyon include a mix of Mexican, Mestiso, and Tarahumara (Mexican Indian). The Tarahumara (or Raramuri, as they call themselves) live solitary lives away from town—farming and ranching their small homesteads and plots of land. Occasionally, they come into town for supplies or to celebrate Easter or some other religious holiday.

The small towns in and around the canyon are made up of Mexican and Mestiso. The towns consist of a few homes, a church, and typically a general store. Electricity is sparse, telephones are even more rare, and TVs and radios virtually do not exist.

Most often, the horse trips have a destination such as Batopilas, a small "tourist" town at the bottom of Urique Canyon, which was one of the major silver mining communities in the late 1800s and early 1900s and the 2nd town in Mexico to have electricity. Alexander Shepard established the Batopilas Mining Company in 1880, which during its glory days processed 20 million ounces of silver ranking the Batopilas Mine among the richest silver mines in the world.

Occasionally, the horse trips are simply exploratory, seeking new routes into different areas. One place that the group of friends would like to explore is a gold mine called the "Lluvia de Oro," which Victor Villaseñor wrote about in his popular book "Rain of Gold."

Dave emphasizes that the mindset in the Canyon is completely different than in the United States. It's not just the difference in technology and the slow-paced lifestyle that he's referring to when he talks about this. He says, "Here, in the U.S., if you need help of any kind, you are only minutes or hours away from it. In the canyon, you are on your own. It's a completely different mindset." If something happens to you, you had best be prepared to deal with it on your own because there is no Medivac or help around the corner. Dave had his own personal taste of this on last fall's excursion, when his horse lost its footing and Dave went down 15 – 18 ft, head over heels with the horse on top of him. He miraculously managed to miss hitting his head on the rocky terrain; however, he did break three ribs and scraped and bruised himself severely from his shoulders to his knees. From our experience with television and every day life in America, it would be easy to believe that Dave would be carried out on a stretcher by his friends or perhaps left while someone went for help, but this was not the case. Distances are too far and water so rare, that it would have meant certain death for Dave. So, once Dave came to after his fall, he got back on his horse and rode 4 hours until the group reached a ranch where he could lay down for some primitive (to our standards) doctoring. The wrangler from the ranch rode into Betopilas to find a truck, but was unsuccessful; however he did return with a large syringe and multiple vials of unknown drugs, which Dave received in earnest. Since he had no other choice Dave and his group of friends made their way on foot and by horse back to Batopilas. It took nearly an entire day to get there because Dave could not travel any faster. In Batopilas they managed to finagle a ride in a van with two tourists to Creel where Dave was able to take the train back to the Ranch where he waited for his companions to return. From there he traveled to El Paso by train and by bus. Once he made it to El Paso, Dave figured the rest of the ride back to northern New Mexico was easy even though he drove himself the 350+ miles from El Paso to Santa Fe. It took eight days from the time of his fall to when he finally reached what we would consider adequate medical treatment.



Clockwise from left: A typical inner canyon trail. Right: Crossing the Urique River below Guaplayna. Bottom: Looking back over Urique Canyon. The horse trip originated beyond the visible horizon on the other side of the mountains.

Since this particular incident, many of Dave's friends have asked him whether he will be returning to Mexico for more horse trips. He admits to being quite surprised at the question. His answer is an incredulous "Of course. You get in your car every day and drive to work. You have as much of a chance at getting hit there as you do ending up in trouble on horseback in the wilderness."

Dave and his companions had planned to take a summer trip to the Lluvia gold mine, but because the summer temperatures are so severe (114 ℉ in the canyon) they are looking for a better time of year. For now, he's settling for a 5-day horse trip in the Colorado Sangres this July.

Top: Two Tarahumara Indian girls selling yucca baskets near Creel. They are quite shy and will not look at the camera. Bottom: Dave's group presents a statue of the Virgin to the Guadelupe-Coronado church, which has a dirt floor and is approximately 360 years old.

Safety for you . . .

The Seven Guiding Principles to ISM

The Laboratory and the Department of Energy have agreed to the following seven guiding principles to provide overall direction and guidance for instituting Integrated Safety Management:

1. **Workforce Responsibility and Accountability**
   Line management is responsible and accountable for the protection of employees, the public, and the environment. Everyone is responsible and accountable for the safe conduct of their activities.
2. **Clear Roles, Responsibilities, and Authorities**
   There are clear roles and lines of responsibility, authority, and accountability at all levels of the organization to ensure protection of employees, the public, and the environment.
3. **Competence Commensurate with Responsibilities**
   All employees have the experience, knowledge, skills, and abilities needed to perform their work safely and competently.
4. **Balanced Priorities**
   Management will allocate resources to address safety, programmatic, and operational considerations. No work will be performed unless it can be performed safely.
5. **Identification of ES&H Standards and Requirements**
   Hazards shall be evaluated and appropriate controls implemented before work is performed to provide adequate protection to employees the public, and the environment.
6. **Hazard Controls Tailored to Work Being Performed**
   Engineered and administrative controls shall be in place to prevent and control work-associated hazards.
7. **Work Authorization**
   No work will be performed unless it can be shown to be done safely.

July 2001

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

August 2001

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

July 4	Independance Day
July 11	EPE Frito Pie Day
July 23	July/August Group Meeting 10:30 a.m. at the MSL Auditorium

Security Begins with You

ESCORTING

An individual can be escorted when:

An uncleared United States citizen can be escorted into a cleared area if the person being escorted can be precluded from access to classified matter and/or categories of SNM requiring access authorization. An individual cannot be escorted into a cleared area if the individual has had a clearance denied, revoked or suspended.

Employer Responsibilities:

- Know the clearance status of each employee
- Do not authorize escorting of any employee whose clearance is currently suspended, denied, or revoked.
- Do not attempt to elicit information regarding why a clearance was denied, revoked or suspended.
- Request verification, verbal or written, from other employers (sub-contractors, other DOE sites, DOD, etc.) if eligible for escort.
- Cannot ask for clearance status for individuals employed elsewhere.

Employee Responsibilities:

- If clearance is currently denied, revoked or suspended, make sure your manager is informed.
- Decline to be escorted into a cleared area.

Privacy Act Information:

The Privacy Act protects individuals from release of private information including the status of clearance, except to those individuals with a need to know. Only the individual's manager has the need to know.

Los Alamos NATIONAL LABORATORY

ESA-EPE Group Office: Paul Wantuck, Group Leader; Gary Read, Deputy Group Leader; Margaret White, Group Office Administrator; Lisa Lindberg, Writer/Editor.

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